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ENHANCEMENT OF PRODUCTIVITY IN PRESS SHOP OF AN AUTOMOBILE INDUSTRY

GANESH M. R[1], BENNY PAUL[2], V. NARAYANAN UNNI[3] & PRAKASH M. KALLANICKAL[4]

[1]P. G. Scholar, Department of Mechanical Engineering, Mar Athanasius College of Engineering, Kothamangalam, Kerala, India

[2,3]Professor, Department of Mechanical Engineering, Mar Athanasius College of Engineering, Kothamangalam, Kerala, India

[4]Associate Professor, Department of Mechanical Engineering, Mar Athanasius College of Engineering, Kothamangalam, Kerala, India

ABSTRACT

Enhancement of productivity is the foremost goal of any of the production or manufacturing industries. This requires detailed study of the process undergone by any industry, analyzing it, finding out where the efficiency can be improved and the root cause of the efficiency drop. A major tool in this area is root cause analysis. In this paper the efficiency drop of the press shop in a leading automobile manufacturing company has been analyzed by root cause analysis method. The major contributors for the efficiency drop have been identified and suggestions were given to overcome these problems. By implementing the suggestions about 38% reduction in the line stoppage can be obtained.

KEYWORDS: HDA Fault, Cause and Effect Diagram, Production Efficiency

INTRODUCTION

In this competitive world it is important for any industry to become competitive with their rival firms. For that every industry must be excellent in their own means. One of the best ways to become competitive is to improve the efficiency of the firm. Detailed studies are being down for improving the efficiency. This research paper does such a study in a leading automobile company for the improvement of their efficiency in press shop. The major problem causing the efficiency is found by breaking down the problem and recommendations are suggested for removing the problem. Various statistical tools are used for problem solving.

PROBLEM SOLVING METHODOLOGY

In this paper effort is made to improve the production efficiency of the press shop in an automobile company. The problem solving methodology adopted for this paper is as follows:

First of all the processes in the press machine are studied in detail. The problem of HDA Late Sense is thoroughly understood by close observation and by consulting concerned persons.

Then the data of the occurrence of the problem for one month (August 2013) is collected. An analysis on the data collected is done based on various criteria

Root cause analysis is made for the problem identified

Major reason for the occurrence of the problem are identified and discussed with the concerned members for their opinion.

The counter measure is planned and executed.

The data of occurrence of the problem after the execution of the counter measure was collected.

From the post execution data the reduction/elimination of the problem is confirmed.

Suggestions are put forward for eliminating the root cause of the problem.

PROBLEM DESCRIPTION

The foremost process in an automobile manufacturing industry starts from press shop. This paper is based on the production efficiency improvement of the press shop. The production efficiency of three press units 21C, 22A and 24A servo machines are found to be 92.7%, 95.5%and 94.0% for the month of August. For the improvement of the press shop machine with the least efficiency is studied. Hence the press machine 21C is selected for the study.

On analysis it was found that different problems are there leading to this efficiency drop. For the sake of identification of the area to be studied, efficiency drop due to various sections that are involved in the production process is categorised. The total production time for the 21C for the month of August was 10050 min. In that there was 733 min line stop. Hence the production efficiency calculated on the basis of line stop time is 92.7%. Various department contributions towards this net line stop were analysed. As a result the following data is obtained. The data is shown in cause effect diagram and in the Table 1.

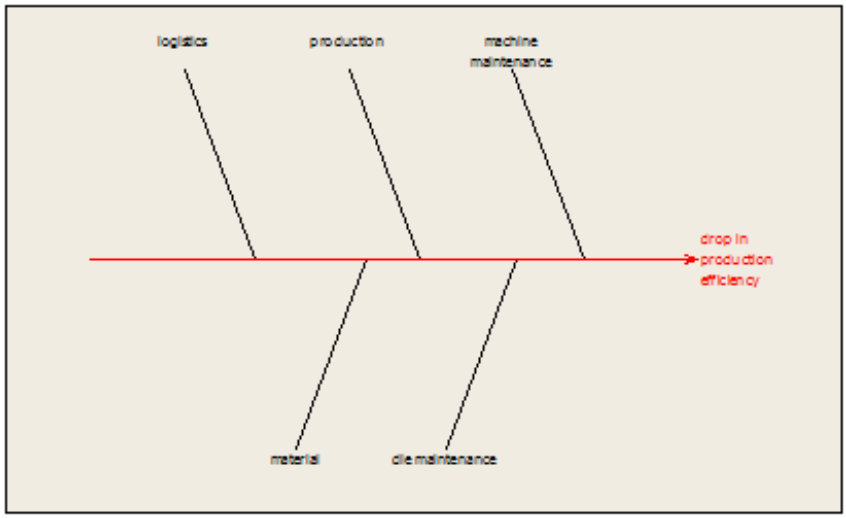

Figure 1: Cause and Effect Diagram for Production Efficiency Drop

Table 1: Line Stop Contribution of Various Sections

Section	Line Stop Time (in min)	Percentage
Machine maintenance	367	50.06
Die maintenance	155	21.14
Production(line)	114	15.55
Material(quality)	87	11.86
Logistics	10	1.3

The Pareto chart of the data is shown in Figure 2.

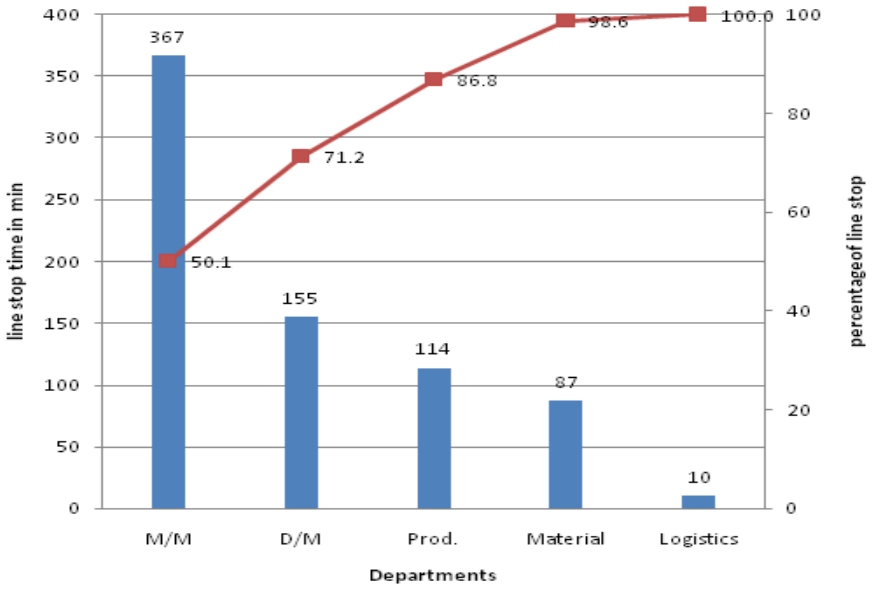

Figure 2: Line Stop Contribution of Various Departments

It is found that the major line stop is due to machine maintenance and Die maintenance departments. Because of the time constraint and the facility constraint machine maintenance section is taken for the further study. In the machine maintenance section, the problems causing the line stoppage is studied in detail. The obtained data is shown in cause effect diagram and in the Table 2.

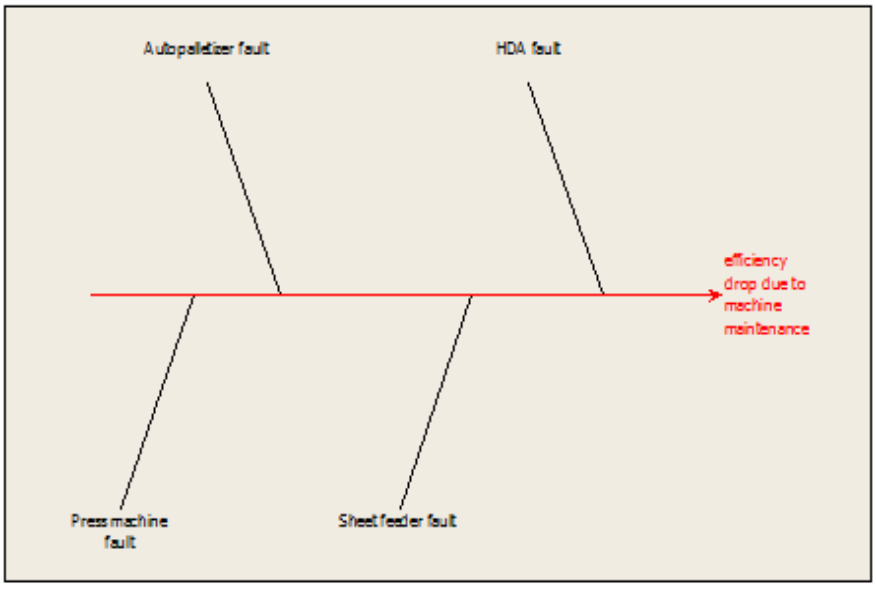

Figure 3: Cause and Effect Diagram for Efficiency Drop Due to Machine Maintenance

Table 2: List of Contribution of Various Problems in Machine Maintenance towards the Line Stoppage

Handling Device Accessories problem	152	41.4
Sheet feeder vacuum fault problem	132	36
Autopalletizer fault	50	13.6
Press machine fault	33	9

The data in the above table is shown as a Pareto chart in Figure 4.

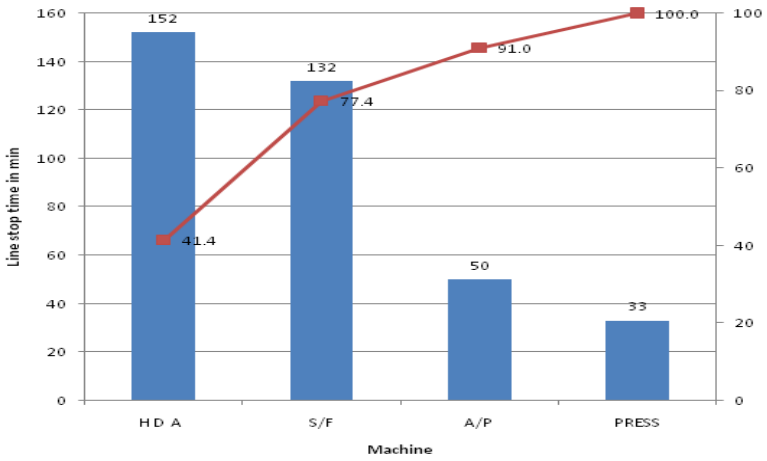

Figure 4: Machine Maintenance Line Stop Time Split up

From the Figure 4 it is clear that major contributor of the line stoppage is due to Handling Device Accessories Fault. Now the problem is studied in detail for improving the efficiency of production. The breakdown is done due to the time constraint of the research time. By performing this breakdown it is possible to concentrate on the lion's share of the problem of efficiency drop in the press shop of an automobile industry.

Description of HDA Late Sense Problem

In the press shop blanks from the supplier is converted to panels by using press machine. The logistic member loads the blanks in the crane saver. Then these blanks are fed to the centering station with the help of Sheet feeder Robots. In centering station the blanks are aligned for feeding in to the press machine. There are three press in a line. The blanks from one press are moved to other by using Transfer robots. A schematic diagram of the 21C servo press machine is shown in the Figure 5.

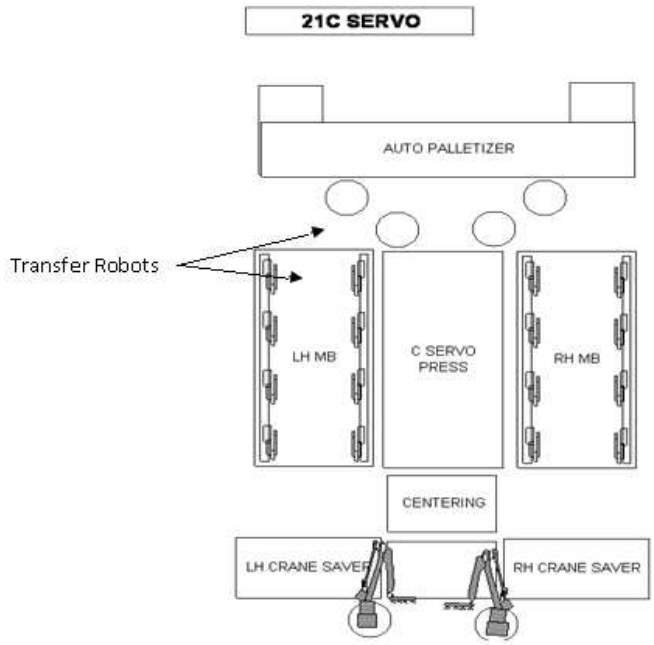

Figure 5: Schematic Diagram of the 21C Servo Press Machine

There are two moving bolsters one in left side and another in the right side of the C servo press. This is to reduce the preparation time for the production of next die. While the die in the right side moving bolster in the production the next die to be produced can the set in the left side moving bolster. These transfer robots are equipped with Handling Device Accessories (HDA) which picks the sheet from one work station to another. For each different die there are different HDA according to the profile of the blank that is to be pressed. These HDA are connected to the transfer robot manually at the time of die change. Sensors are mounted in these HDAs for sensing the presence of the blank in the member. Sometimes while transferring sheet metal from one w/s to another the Handling Device Accessories (HDA) actually holds the sheet but the sensor does not senses the sheet resulting in the stoppage of the entire line. This problem is termed as HDA Late Sense problem or HAD fault. The reason of the line stoppage due to this problem is to be identified and studied.

Data Collection for HDA Fault

The data of breakdown with respect to the finger of the transfer robot and moving bloster are collected for the month of August is collected and tabulated. The data is shown in the Table 3. The unfilled cells show that in that particular location there is no breakdowns.

Table 3: Data Showing Breakdown Time with Respect to Moving Bolster Location

Moving Bolster Location Wise Break Down Data							
Right Hand Side				Left Hand Side			
Right Location No	Breakdown in Right Side	Left Location No	Breakdown Left Side	Right Location No	Breakdown in Right Side	Left Location No	Breakdown in Left Side
1		1	2	1		1	1
2	**15**	2		2	1	2	
3	3	3	2	3	4	3	
4		4	1	4	1	4	1
5		5		5		5	
6	3	6	1	6	3	6	
7		7	1	7	4	7	1
8	2	8		8		8	
9		9		9		9	
10	**12**	10	**9**	10	2	10	
11	**15**	11	**11**	11	3	11	2
12		12		12		12	
13	3	13	2	13	2	13	
14	**11**	14		14	4	14	**12**
15	4	15		15	**11**	15	3

The data in Table 3 is represented in a graph which is shown in the Figure 6.

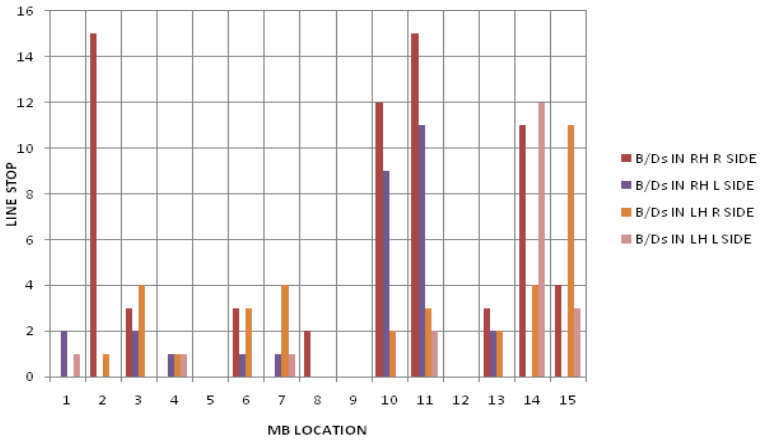

Figure 6: Location Wise Breakdown Data

From the figure it is found the problem is evenly distributed throughout all the fingers. For the experiment purpose due to spare part availability and cost concern, locations were more breakdowns happened are identified. They are as

RIGHT HAND SIDE MOVING BOLSTER – R2 R10 R11 R14 L10 L11

LEFT HAND SIDE MOVING BOLSTER – R15 L14

Now the root cause analysis is performed for the HDA fault. The root cause analysis for the problem is shown in the Figure 7.

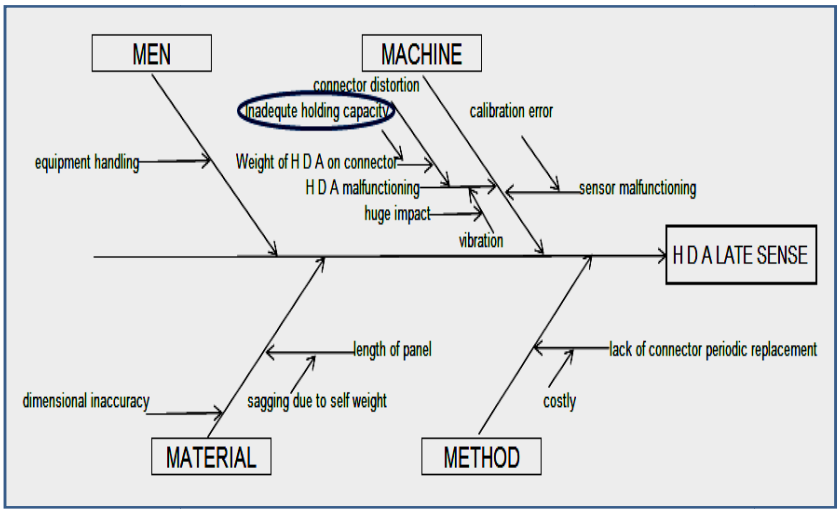

Figure 7: Cause and Effect Diagram for the HDA Late Sense Problem

Different possible causes for the problem are identified on the basis of 4Ms. Each cause is studied and many causes are ruled out for the following reasons:

- Almost the entire process automated. Only human intervention leading to the problem is found during the HDA member replacement at the time of die change. The replacement procedure was closely observed and no abnormality was found
- Sensor was also checked for any malfunctioning and that was also found in working condition.
- Another possibility was with the panel. Dimensional inaccuracy can also lead to the problem. But if there is an inaccuracy the sensors in the centering station will identify that and the line stoppage happens then and there.
- Sagging due to the weight of the panel is also not happening
- Preventive maintenance is also happening regularly
- Frequent replacement of the connector is also not feasible as the connector set is costly.

The reason for the problem of HDA late sense occurs due to the distortion of the connectors. The cause of this distortion is the HDA weight on the connector pins. The weight of the HDA equipment is at an average of 8kg ranging from 5 kg to 13.5 kg. This connector is affected by this weight resulting in the distortion of the pins. The temporary counter measure taken by the concerned member on the production line is to bend the pin manually which solves the problem

temporarily. This confirms the root cause as the distortion of the connector pins which is due to the weight of the HDA member. Also locations where heavier and lengthier HDAs are fixed are the most vulnerable spots of this HDA Late Sense problem.

As the most locations where the break downs occurring frequently are identified the connectors at the corresponding locations are changed according to the availability of the same in the maintenance store. After the replacement also the occurrence of the problem is closely observed and it was found that the problem did not occur in those locations. Hence it has been confirmed that the problem is with the connector.

RECOMMENDATIONS

As the weight of the HDA member on the connector/connector pin is identified to be the root cause for the problem a holder can be placed on the robot arm holding the HDA. This holder should be adequate to hold the weight of the HDA thus by reducing/eliminating the weight on the connector thus by solving the problem permanently.

CONCLUSIONS

Case study was performed for increasing the line efficiency of 21C servo. Breaking down the problem it was able to understand that one of the major contributors to the line stoppage was HDA late sense problem. The problem is analyzed and the root cause analysis is performed. It was seen that the weight of HDA on the connector was the actual problem. A holder holding the HDA there by preventing the connector distortion solves the problem permanently.

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